Does leadership promote cooperation in climate change mitigation policy?

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Abstract

In the run-up to the Copenhagen negotiations, commentators, politicians and the public had great expectations of some state taking the lead towards a new global climate deal. Is there something in such a call for leadership? In two steps, this paper provides an empirically informed answer to that question: The first part develops a theoretical account of the relation between leadership and cooperation in international climate change mitigation policy (ICCMP). Starting from a five-dimensional leadership account and a simple game-theoretical analysis of the impediments to cooperation, it is predicted that (1) increased leadership facilitates cooperation in ICCMP and that (2) different leadership modes contribute to cooperation in varying degrees. The second part tests these hypotheses: A new leadership index measures the extent to which the EU exhibited leadership at the negotiations of the Conference of the Parties (COP) between 1995 and 2008. We find that it positively correlates with the level of cooperation arrived at. The result also holds for four out of five leadership dimensions. We conclude with a discussion of the scope of the result and its policy implications.

Key words

leadership – cooperation – climate change policies – mitigation – European Union

Introduction

Climate change mitigation has been subject of international negotiations since the late 1980s. However, progress is modest, given that the atmospheric concentration of greenhouse gases (GHG) continues to rise. So international cooperation to mitigate global warming seems to fail. Many people have pinned their hopes on some state which leads the climate change negotiations by setting a good example and bringing other states on board. For instance, the former UN Secretary General Kofi Annan traced global warming back to a "frightening lack of leadership" (Gettleman 2006). The expectation is that a leader enables and contributes to successful cooperation in international climate change mitigation policy (ICCMP). This paper examines whether this expectation stands up to an empirical test: Does leadership promote cooperation?

Recent research deals with this question in three different threads: At the level of grand theories of international relations, the theory of hegemonic stability (Kindleberger 1973, Gilpin 1975) and the theory of institutional bargaining (Young 1989, 1991) argue that a leader is a prerequisite of international cooperation. For the first, leaders are hegemons which either unilaterally provide international institutions or use their predominant power to enforce cooperation; but leadership is more than that. This is reflected in the Young's approach, which develops a more comprehensive view on leadership (similarly Underdal 1991, 1994 and Malnes 1995): Young takes leaders to be individuals (rather than collective agents), who try to overcome problems in institutional bargaining by several means.[1] However, he fails to analyse *how* a leader facilitates cooperation (a similar objection applies to

Malnes 1995). Moreover, due to a small sample size and a lack of variation in the dependent variable, the theory's empirical support (Young & Osherenko 1993) is quite weak (cp. Hasenclever et al. 1997, 78f.). Second, at the level of mid-range theories about the supply of public goods, many authors regard leadership as a condition of cooperation (understood as the supply of public goods). However, they either narrowly conceive leadership as unilaterally solving a collective problem and neglect that leaders also push for agreement (Jones 1978, Guttman 1982, Hoel 1991, Murdoch & Sandler 1997, Arce M. 2001). Or they do not empirically test their theories (for exceptions, cp. Murdoch & Sandler 1997, Ward et al. 2001). Third, at the level of specific policy analysis, leadership is examined in different contexts (for international climate policy, cp. Gupta & Grubb 2000, Gupta & Ringius 2001, Andresen & Agrawala 2002, Christiansen & Wettestad 2003; for international trade policy, cp. Vahl 1997). However, these analyses focus on conceptualising and identifying leadership, but do not consider it as an explanatory variable for cooperation.

Hence, current research has not adequately answered the question of whether (and how) leadership affects cooperation: Either it provides an elaborated leadership account but fails to address its empirical implications for international cooperation; or it examines the relation between leadership and cooperation based on a rudimentary leadership account. The aim of this paper is to combine both approaches – i.e. to derive hypotheses about how leadership affects cooperation from an elaborate leadership account (sections 1–3) and to empirically test them by a

standardized quantitative framework which goes beyond the case-study based empirical research so far (sections 4–6).

1. A five-dimensional leadership account

Leadership is a form of behaviour which is – as any other behaviour – characterized by specific *intentions* and specific *means* to realize the intentions. On the intention-side, two things make a political agent a leader (Young 1991: 285; Underdal 1994: 178, 181; Malnes 1995: 92): First, he intends to contribute to the solution of a collective action problem *himself*. Second, he wants *others* to contribute to solving it, too.

But good intentions are not enough; a leader also puts his aims into action. He does so by using different means. These fall into five categories (henceforth called "leadership modes"). The first, *unilateral leadership*, concerns the extent to which an agent sets a good example in solving collective action problems. He can do so (1) by formulating specific goals for his own policy to solve the problem. But to be credible, "cheap talk" is not sufficient (cp. Underdal 1991: 143); a leader also has (2) to elaborate and implement instruments (e.g. technologies, funding) and (3) to actually achieve his self-imposed goals.

While unilateral leadership relates to the first of a leader's intentions, the other four leadership modes relate to the second intention. One way in which a leader may encourage others to contribute to solving a collective problem is by using "hard" power and control over valuable resources (like raw materials or military power). More specifically, he can apply sanctions against defectors (e.g. embargoes) or offer

incentives for contributors (e.g. additional development aid). A leader thereby exhibits *structural leadership*.

The third leadership mode, *problem-solving leadership*, concerns the extent to which a leader pushes on international negotiations and tries to break deadlocks by using his negotiation skills. He does so, first, by influencing the common basis for negotiations and working towards a common understanding of the underlying problem. More specifically, he sets the problem on the agenda of negotiation[2] or supports a certain interpretation of the problem (issue framing). Second, a leader advances negotiations by facilitating communication or balancing interests between different parties (mediation). Third, he links different problems with each other to create "negotiation packages" which meet the different claims and interests of the parties involved (issue linkage). For instance, linking deforestation and climate change mitigation by treating conservation of forests and GHG reductions equivalently may encourage densely wooded states to participate in climate negotiations.

Moreover, a leader employs his cognitive resources – knowledge, weltanschauung, ideas or moral convictions – to convince others to do their share in solving a collective problem. He thereby exhibits the fourth mode, *intellectual leadership*. In the context of ICCMP, this mainly involves referring to the scientific expertise about the causes and consequences of climate change.

Finally, in order to bring others on board, a leader can provide and support institutions which facilitate cooperation. This includes financing an institution's budget and bearing other states' expenses which arise from monitoring of or

compliance with an international agreement. These means make up a fifth leadership mode, *institutional leadership*. Table 1 summarizes the five leadership modes and the associated means.

leadership mode	basis	means	variable name
unilateral	setting a good example	formulation of goals	TAR
		proposing instruments	PROP
		achieving goals	TAR-A
structural	power and resources	threats/sanctions	SANCT
		offers/incentives	INCENT
problem-solving	negotiation skills	issue framing	FRAM
		mediation	–
		issue linkage	LINK
intellectual	cognitive resources	reference to scientific expertise	BUDGET-IPCC
institutional	institutions	supply and support of institutions	BUDGET-UNFCCC

Table 1: The five leadership modes, their bases, the associated means and the corresponding variable names used in the operationalisation

Note that, on this account, it is not part of the leadership concept that a leader has to actually generate followers (as emphasized by Underdal 1994: 195). What is constitutive of a leader, however, is that he has the *intention* to get others on board, i.e. that he *tries* to generate followers. Whether or not he is successful (and thereby solves the problem) is a separate question and is partly covered by the concept of cooperation (cp. section 2).

The proposed account will guide the construction of a new leadership index in section 4. As this will allow for a comparison with other accounts, it is helpful to relate the proposal to the three prevailing typologies of leadership means by Young (1991), Underdal (1994) and Malnes (1995) (cp. Table 2): What we call "unilateral

leadership" was first emphasized by Underdal, but neglected by Young. Malnes mixed it up with what we name "intellectual leadership" and labelled both "directional leadership". The use of power and resources (structural leadership) figures prominently in Young's account (1991: 287ff.); Underdal (1994: 186f.) and Malnes (1995: 96f. 12) named it "coercive leadership" or "threats and offers", respectively. The best elaboration of problem-solving leadership is Malnes' (1991: 91f.), though the other two considered it under different headings ("entrepreneurial leadership", Young 1991: 287, and "instrumental leadership", Underdal 1994: 188). The term "intellectual leadership" is borrowed from Young (1991: 287); Malnes partly included it in his "directional" leadership (Malnes 1995: 104), while Underdal ignored it. Finally, none of the three dealt with institutional leadership. But the theory of hegemonic stability emphasizes that benign hegemons contribute to the solution of a collective problem by supplying institutions. This feature can be regarded as an aspect of leadership more broadly conceived – which is the reason why it seems sensible to include it in a comprehensive leadership account. In summary, the proposed account is a synthesis of existing conceptions (for preparatory work at such a synthesis, cp. Grubb & Gupta 2000, Kanie 2005). It provides a common framework which will allow to compare and asses their relative strengths and weaknesses.

proposal	Young	Underdal	Malnes
unilateral	–	unilateral	directional
structural	structural	coercive	threats & offers
problem-solving	entrepreneurial	instrumental	problem-solving
intellectual	intellectual	–	directional
institutional	–	–	–

Table 2: Leadership modes in the proposed account and their counterparts in Young's, Underdal's and Malnes's accounts

Before deriving hypotheses about how a leader may facilitate cooperation in ICCMP, we have to deal with a conceptual challenge: Skodvin & Andresen (2006) argue that the leadership concept itself is not sufficiently elaborated to be of use for empirical analyses, because leadership cannot be distinguished from other bargaining behaviour. They offer two arguments: First, at the level of the leader's *motives*, the prevailing accounts have to assume that a leader is motivated by collective goals in order to set leaders apart from "ordinary" bargaining parties which are motivated by self-interest. And this, Skodvin & Andresen argue, is inconsistent with the use of structural (or coercive) leadership, which is based on self-interest. Second, at the level of the leader's *capacities*, the prevailing accounts characterise leadership by abilities (e.g. control over events important to others, skill, energy, status) which are not specific to leaders, but rather shared by all bargaining parties.

While it is true that Young, Underdal and Malnes are ambiguous on a leader's ultimate motivation, this does not defeat the proposed synthesis. It characterises a leader by his intentions or goals rather than his motives for pursuing these goals:

Whether a leader ultimately wants to solve a collective problem out of an altruistic concern or out of self-interest is irrelevant as long as he tries to solve it – i.e. as long as he wants to make a contribution himself and wants to push others to do so, too. So Skodvin & Andresen's first worry does not apply in the present context. The second worry, however, imposes constraints on our empirical analysis: Instead of measuring a leader's capacities, a more promising operationalisation of leadership should focus on the extent to which these capacities are *exercised*. This is precisely what sets a leader apart from ordinary bargaining parties: he exercises certain capacities (which others might also possess) to solve a collective problem. So when operationalising leadership in ICCMP, we will for instance measure an agent's actual GHG reductions and financial contributions (rather than her reduction potential or her capacity for financial contributions) relative to the performance of other important agents.

2. Impediments to cooperation in ICCMP

The mitigation of climate change is the central issue in international climate policy. But no single state is in a position to stop climate change by his own; rather, mitigation calls for collective action: Many – if not all – states have to contribute in order to limit global warming. Moreover, their contributions must be coordinated. The coordination of several states' policies in order to solve a collective problem is called (international) *cooperation* (Keohane 1984: 51). Cooperation is thus a necessary condition of successful climate change mitigation. However, international cooperation does not arise on its own: Atmospheric GHG concentration continues to rise and is projected to strongly increase over the next decades (IPCC 2007). So until

today, cooperation in ICCMP has run into obstacles. In order to understand whether and how a leader promotes cooperation, one has to understand these obstacles he has to overcome. What, then, impedes successful cooperation in ICCMP?

A game-theoretic approach to this question seems promising, as it is the very object of game theory to explain success and failure of cooperation in social interactions. The framework is deliberately kept simple, as it merely aims to identify the structure of the problem (i.e. the impediments to cooperation). It is not intended to model the course of ICCMP-negotiations or to predict its outcomes. For the latter, a 190-player game would be appropriate. For our purpose, a 2-player game will do. This is a common approach in research on ICCMP, which understands the problem of climate change mitigation, i.e. of reducing GHG emissions, as a prisoner's dilemma game (cp. Sandler 1997: 101; Finus 2001: 3f., 22f.):[3] Suppose that two states, *A* and *B*, can either reduce their GHG emissions (strategy *R*) or not (strategy -*R*). *A* and *B* are assumed to choose the strategy that maximises their benefits. Each state's benefit depends on its own and the other state's strategy: First, if both *A* and *B* reduce their emissions, climate change is mitigated; both bear some costs, but there is a considerable positive pay-off for both, because the costs of climate change exceed the costs of its mitigation (Stern 2006). Second, if both *A* and *B* do not reduce their emissions, global warming becomes inexorable and both states are worse off than in the first case. Third, if one state reduces its emissions while the other does not, climate change decelerates; so both states enjoy some positive benefits (which are less than in the first case), but only one state bears the expenses of reduction while the other one free-rides.

Let [*x*,*y*] denote the strategy pair in which state *A* chooses *x* and *B* chooses *y*. Then *A* will prefer [-*R*,*R*] to [*R*,*R*] to [-*R*,-*R*] to [*R*,-*R*]. Similarly, *B* will prefer [*R*,-*R*] to [*R*,*R*] to [-*R*,-*R*] to [-*R*,*R*]. Representing the rank of a strategy pair [*x*,*y*] in each state's preference ordering by the integers 1 to 4 (where 4 stands for the most prefered outcome), each strategy pair [*x*,*y*] can be mapped onto a pair (*i*,*j*) where *i* represents the rank of the strategy pair [*x*,*y*] in *A*'s preference ordering and *j* is the rank of [*x*,*y*] in *B*'s ordering. Table 3 (the so-called "pay-off matrix") summarizes the structure of the problem of climate change mitigation.

		state B	
		R	$-R$
state A	R	$(3,3)$	$(1,4)$
	$-R$	$(4,1)$	$(2,2)$

Table 3: The pay-off matrix for the problem of climate change mitigation

For each state, the instrumentally rational option to choose is not to reduce its emissions: If *B* reduces, *A* will maximise its benefits by not reducing. And if *B* does not reduce, *A* will be better off by not reducing either. So regardless of *B*'s choice, *A* will benefit most from not reducing its emissions. As the same reasoning applies to *B*, neither state will reduce its emissions. Hence the dilemma: Although both state choose the individually rational option, the outcome of the interaction, [-*R*,-*R*], is – according to both states' preference rankings – *inferior* to the alternative of climate

change mitigation, [*R*, *R*].[4] This is why in ICCMP, cooperation fails: Each state has overriding incentives to deviate from the cooperative outcome. Hence, the pay-off structure of the participating states in international climate change negotiations is the first impediment to cooperation in ICCMP.

One might object that both states can escape the dilemma if they communicate with each other. They then should realize that they can reach a Pareto-better outcome if both reduce their emissions and the problem would resolve. But this is untrue: As there is no international authority to enforce international environmental agreements, any such agreement is not binding. So each state has to take into account the possibility that the other state breaks the agreement. But if *B* breaks the agreement, it will be rational for *A* to do so, too. And if *B* does comply with the agreement, *A* still has an incentive to break it, because in absence of enforcing authorities, breaking the agreement will have no negative consequences. So even if states agreed to reduce their GHG emissions, it would still be a dominant strategy for each state to break the agreement and not to reduce its emissions. Thus, the lack of binding agreements (and correspondingly, the lack of enforcing institutions) is the second impediment to cooperation in ICCMP.

3. How leadership affects cooperation: hypotheses

The previous analysis identified two impediments to cooperation in ICCMP. Therefore, there are also *two* principal ways in which a leader can promote cooperation[5] – a result which is also implicit in Underdal's analysis (Underdal 1991: 140, 143): First, he can change the pay-off structure by increasing the benefits of

strategy *R* or the costs of -*R,* thereby modifying each state's preference ordering such that the cooperative strategy – reducing emissions – becomes dominant (Oye 1986: 9). Second, he can increase enforceability and binding character of agreements to reduce GHG emissions; this supports mutual trust and reliance between the negotiating parties, which in turn helps to attain the Pareto-optimal outcome, i.e. climate change mitigation. To promote cooperation in either or both ways, a leader can employ the specific leadership means identified in section 1.

Changing the pay-off structure of the interaction

A leader may change the pay-off structure by using means out of four leadership modes: *Unilateral leadership* consists in formulating goals, elaborating instruments, and achieving the goals. With each of these, a leader convinces other states that mitigating climate change is less costly than previously thought. This may encourage others to reassess the costs of climate change mitigation; and, holding the advantages of mitigation constant, lower expected mitigation costs increase the willingness to contribute one's share (Acre M. 2001: 115f.; for a critique, cp. Hoel 1991: 55).

Structural leadership includes sanctions and incentives, both of which may be employed by a leader to change the pay-off structure of the interaction in ICCMP: Sanctions (e.g. trade embargoes) on those unwilling to reduce their emissions increase the costs of the non-cooperative strategy -*R*; to the contrary, incentives or compensations (e.g. additional development aid, transfer of technology) for those willing to reduce their emissions increase the benefits of the cooperative strategy *R*. So *R* becomes more attractive relative to -*R*, which promotes the cooperative outcome [*R*,*R*].

Within the *problem-solving leadership* mode, issue framing and issue linkage have similar effects: By *framing* the problem of climate change in a certain way – e.g. as a common problem or a problem which is economically feasible to surmount – a leader can promote a common interpretation of the underlying problem; this may change the perception of the costs of idleness and mitigation (cp. Oye 1986: 9, 11). By *linking* climate change mitigation to other issues like development aid or sustainable development, a leader can help to compensate for the costs of GHG reductions by facilitating economic development; this may encourage others to reduce their emissions (cp. Oye 1986: 11; Folmer et al. 1993: 315).

Finally, via using expertise and knowledge, *intellectual leadership* changes the pay-off structure, too: For instance, with reference to scientific research, a leader can affect other states' beliefs about cause-and-effect-chains, about their role within that chain, and about the likely consequences and costs of not reducing emissions – and states may change their preference ordering once they have reassessed the costs of *-R* (e.g. water shortage, crop failures etc.). Hence, they will be more likely to contribute to climate change mitigation (cp. Simmons & Martin 2002: 200).

Increasing the enforceability of agreements

The second strategy to promote cooperation is to increase the enforceability and binding character of agreements to reduce GHG emissions. Here, a leader can draw on three leadership modes. With all means from *unilateral leadership*, a leader displays that he himself contributes to the solution of the collective problem, irrespective of what others do. This helps dissolving other states' doubts about whether those who announce to cooperate really do so. So, unilateral leadership

creates trust, decreases uncertainty and increases the credibility of cooperative intentions (Oye 1986: 9-10; Underdal 1994: 185).

A second way to strengthen the enforceability of agreements is to apply (positive or negative) sanctions, i.e. to employ *structural leadership*. Sanctions can others make feel that agreements are rationally binding (even if they are not legally binding): As a threat of sanctions applies equally to all, each state has an additional incentive to cooperate; this in turn changes each state's expectation of what the other does – in the light of the further incentive, the other state's cooperation becomes more likely. So each state has to fear less that the other breaks the agreement. This is how structural leadership increases enforceability and trust among the participants.

Third, a leader quite directly affects the enforceability of international agreements by providing and supporting relevant institutions (i.e. by *institutional leadership*): The very essence of an international institution is to establish a legal framework which facilitates communication between the participants, reduces transaction costs (e.g. costs for monitoring of and compliance with an agreement) and increases legal reliability as well as trust (Keohane 1989: 111f.).

Hypotheses

These considerations suggest that a leader can overcome the first impediment to cooperation in ICCMP by drawing on nearly the complete leadership repertoire (eight out of ten leadership means); regarding the second impediment, half of all the means available promote cooperation (cp. Table 4).

leadership mode	means	overcoming impediment	
		pay-off structure	enforceability
unilateral	formulation of goals	×	×
	implementing instruments	×	×
	achieving goals	×	×
structural	threats/sanctions	×	×
	offers/incentives	×	×
problem-solving	issue framing	×	
	mediation		
	issue linkage	×	
intellectual	reference to scientific expertise	×	
institutional	supply and support of institutions		×

Table 4: How the leadership means affect the impediments to cooperation in ICCMP

So the following hypotheses can be derived from the theoretical model: First, other things being equal, increased *leadership with regard to each single leadership mode* facilitates cooperation in ICCMP. This is because each leadership mode contains at least one means which is conducive to cooperation, i.e. which helps to overcome at least one impediment. And second, other things being equal, increased *aggregate leadership* makes cooperation in ICCMP more likely. This is because following the proposed model, increased aggregate leadership consists in increased leadership along at least one leadership mode, which is – according to the first hypothesis – supposed to promote cooperation.

Table 4 also suggests that the different leadership means contribute to cooperation in varying degrees: While the means belonging to the unilateral and structural mode affect both impediments to cooperation, the means belonging to the remaining modes only change one. This implies that the cooperation-conducive

effect of the first group of leadership modes is twice as high as that of the second group. Therefore, the aggregate leadership index to be constructed will reflect this by weighing the sub-indices for the different modes at a ratio of 2:2:1:1:1 (in the order given in Table 4).

The theoretical model's main claim can be summarized as such:

> *Other things being equal, the more a political agent engages as a leader (overall or with regard to a single mode), the more likely is cooperation in ICCMP to take place.*

We now empirically test this prediction.

4. Measuring leadership: a new index

ICCMP, the object of this study, nowadays mainly manifests itself in annual Conferences of the Parties (COPs) of the United Nations Framework Convention on Climate Change (UNFCCC) and – since the accessory Kyoto Protocol has entered into force in 2005 – the Meetings of the Parties of the Protocol (COP/MOPs). The data basis for the empirical test thus covers the COPs from 1995 to 2008 and the COP/MOPs from 2005 to 2008. To test the hypotheses, we assign – to each COP – a value representing the extent of leadership exhibited and a value representing the extent of cooperation achieved. However, as the EU has generally been regarded as the only agent which has *potentially* been able to take the lead in ICCMP (Gupta & Ringius 2001; Hovi et al. 2003: 2; Ott 2004:16), this paper confines to measure the degree of leadership exhibited *by the EU*. So we test the hypotheses by assigning a

value for the EU's[6] leadership and for the cooperation achieved to each COP (including the respective COP/MOP, where appropriate) between 1995 and 2008.

A new leadership index

We do so by drawing on the theoretical model developed above; that is, the leadership index to be constructed (LS-TOTAL) should reflect the five leadership modes and the varying degrees in which they – presumably – facilitate cooperation. The general strategy is to separately operationalise the five modes (unilateral, structural, problem-solving, intellectual and institutional) by five sub-indices (LS-UNI, LS-STRUCT, LS-PROB, LS-INTEL and LS-INST, respectively) and then to aggregate them at a ratio of 2:2:1:1:1 to obtain the aggregate variable LS-TOTAL.[7]

Unilateral leadership consists of (1) formulating specific targets to reduce GHG emissions (variable TAR), (2) actually achieving the self-imposed targets (variable TAR-A) and (3) proposing additional instruments if target achievement is difficult (variable PROP). Correspondingly, the variable for the aggregate sub-index, LS-UNI, is the arithmetic mean of TAR, TAR-A, and PROP. To test for the EU's target formulation (TAR), we used two variables, TAR-1 and TAR-2, and defined TAR as their arithmetic mean: TAR-1 examined whether – at the COP in question – the EU committed itself to a GHG reduction target which is in the upper third of the reduction targets that all other states (excluding the EU member states) agreed upon. This question is not applicable to COPs at which no reduction targets were officially agreed on. So we also assessed whether – according to its national communication or the COP minutes –[8] the EU announced a reduction target which exceeds its reduction target most recently agreed upon at a COP (this is variable TAR-2). In both cases –

as in all operationalising questions to follow – we adopt the general convention that the variable takes on the value 1 if the answer is to the affirmative and 0 otherwise.

The focus on the nominal reduction targets may seem problematic, because it may not reflect the true depth of commitment. Harrison & Sundstrom (2007: 4f.) suggest to consider the reductions relative to the business-as-usual trajectory (to include e.g. "windfall reductions"). However, this will not substantially improve on our proposal because the true depth of commitment depends on the costs of these reductions (so conceived) relative to an agent's GDP – which in turn depend on the structure and average efficiency of its economy. While a more sophisticated operationalisation would indeed be desirable, lacking comparative assessments of the costs in question, we stick to the nominal reduction targets – bearing in mind that this is only a rough approximation to the true depth of commitment.

The second component of unilateral leadership, the EU's target achievement (TAR-A), is likewise measured by two variables: First, we checked whether the EU's GHG emissions fell below or were equal to the linear target path for the year of the COP under consideration (TAR-A1).[9] Even if this question is answered to the negative, the EU might have achieved significant reductions (TAR-A2), where "significant" means that the EU's reduction in the year before the COP in question was greater than the annual reduction of 0.4 percent required by the linear target path. The variable TAR-A is the arithmetic mean of TAR-A1 and TAR-A2.

The third component of LS-UNI manifests itself in proposals of additional reduction instruments if reduction targets (as given by the linear target path) are not met. It is essential to consider only the most important instruments – i.e.

comprehensive, strategic proposals which prepare stakeholders for the future development of European climate change policy and legislation. This is usually done by the so-called White Papers of the European Commission which aim at promoting the further development (and implementation) of an official set of proposals in specific policy areas. Thus, the operationalising question for the variable PROP is: Did the European Commission publish a White Paper on climate policy issues in the year of the COP if its emissions were above its linear target path?

Structural leadership is essentially about applying sanctions and offering incentives. Hence the aggregate sub-index for structural leadership, LS-STRUCT, will be defined as the arithmetic mean of two variables, SANCT and INCENT. The value of SANCT depends on whether (according the the COP minutes) the EU threatened to apply trade embargoes against states which were not willing to reduce its GHG emissions or not.[10] Similarly, the value of INCENT is determined by whether the EU announced additional finance for mitigating climate change in developing countries or not.

Problem-solving leadership is characterized by two features: framing the problem of climate change in a way that supports cooperation and linking climate change mitigation policy to other policy issues. As "hard" evidence to assess issue framing (FRAM) is not available, we scanned the COP minutes for EU statements which promote an understanding of climate change as "a common problem", "a collective task" or urging "a global agreement" (FRAM-1) and for EU statements which describe climate change mitigation instrument as "cost-effective", "economically feasible", "low cost measures" or "economic opportunity" (FRAM-2).

The variable FRAM is the arithmetic mean of FRAM-1 and FRAM-2. Concerning issue linkage (variable LINK), a first reasonable indicator for the EU's engagement is its amount of development aid earmarked for mitigating climate change; for that, we compared the EU's annual contributions to the trust fund of the Global Environment Facility – the most important institution funding projects that protect the environment and especially the climate in developing countries – to the non-European G7-states' contributions (relative to their respective financial potential as given by the gross domestic product).[11] If the EU's contribution was in the upper half of the G7-states in the year of the COP in question, LINK-1 takes the value 1. To also include the EU's effort for issue linkage in direct negotiations, we checked whether the EU mentioned the link between climate change mitigation and poverty reduction or sustainable development by statement analysis (LINK-2). The variable LINK is the arithmetic mean of LINK-1 and LINK-2; similarly, the sub-index measuring problem-solving leadership (LS-PROB) is the arithmetic mean of FRAM and LINK.[12]

Intellectual leadership is tantamount to reference to scientific expertise about causes and effects of climate change. A useful indicator for this is the EU's direct and indirect support of the Intergovernmental Panel on Climate Change (IPCC), the renowned scientific body investigating causes and effects of climate change. Direct support for the IPCC (BUDGET-IPCC) was measured by examining whether the EU contributions to the budget of the IPCC were in the upper half of the non-European G7-states in the year of the COP (BUDGET-IPCC-1).[13] However, as this was always the case and the variable lacked variability, we used a second variable by introducing

a median split *within* the EU's contributions: BUDET-IPCC-2 has the value 1 if the EU contributions to the budget of the IPCC in the year of the COP were in the upper half of its IPCC-contributions between 1995 and 2008. The variable BUDGET-IPCC is the arithmetic mean of BUDGET-IPCC-1 and BUDGET-IPCC-2. To account for the EU's indirect support of the EU (SUPPORT), we draw on statement analysis again and checked the COP minutes for EU statements approving of IPCC results or its activities. The aggregate sub-index measuring intellectual leadership, LS-INTEL, is the arithmetic mean of BUDGET-IPCC and SUPPORT.

Institutional leadership (LS-INST) can both be measured directly and indirectly. It consists in providing institutions; as most institutions in international climate policy are administered by the UNFCCC, it seems sensible to (directly) measure the EU's institutional leadership by the financial support to the UNFCCC (variable BUDGET-UNFCCC). More specifically we asked whether the EU's contributions to the UNFCCC budget were in the upper half of the non-European G7-states in the year of the COP.[14] Again, the problem turned out to be that this variable (BUDGET-UNFCCC-1) showed no variability and hence to refine the measurement, we examined whether the EU's contributions to the UNFCCC budget in the year of the COP under consideration were in the upper half of all of its UNFCCC-budget-contributions between 1995 and 2008 (variable BUDGET-UNFCCC-2). BUDGET-UNFCCC is then calculated as the arithmetic mean of BUDGET-UNFCCC-1 and BUDGET-UNFCCC-2. However, the EU can also show institutional leadership more indirectly by asking for a new compliance mechanism of the UNFCCC or a tightening up of the existing mechanism. This will be true if the COP minutes state

that the EU “supports”, “proposes”, “stresses the need for” the compliance mechanism, or “regrets” its flaws or the lacking progress (variable COMPL). Finally, the aggregate index value for institutional leadership (LS-INST) is the arithmetic mean of BUDGET-UNFCCC and COMPL.

Figure 1 summarizes the construction of the leadership index, gives a list of the variables used in our operationalisation and explains the route of aggregation.

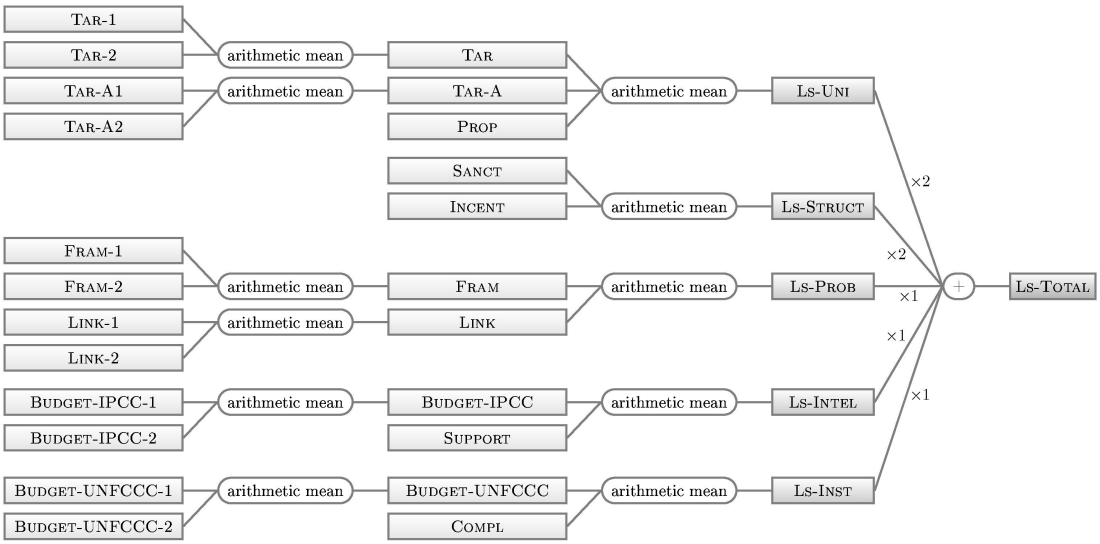

Figure 1: The aggregation scheme for the leadership index

Measuring cooperation

In section 2 we defined cooperation as the coordination of several states' policies aiming at the solution of a collective problem. As policy coordination comes in degrees, there are also different levels of cooperation: The more the negotiating

states adjust their policy concerning some issue to each other, the more they coordinate their policies and the higher the level of cooperation achieved. In the policy area under consideration, cooperation consists in mitigating climate change. This requires that the participating parties agree, first, on targets for the reduction of GHG emissions and, second, on a sanctioning mechanism which ensures that these reduction agreements can be enforced.[15]

Hence, in ICCMP, policy adjustment – i.e. cooperation – happens (or fails to happen) with regard to two issues: the negotiation of agreements for the reduction of GHG emissions, and the negotiation of a compliance mechanism. Regarding the first issue – which is encoded by variable COOP-1 –, three levels of policy adjustment can be distinguished: For a specific COP, cooperation with regard to the first issue failed (COOP-1 = 0) if the international targets to reduce GHG emissions are not developed further. Mid-level cooperation with regard to the first issue is achieved (COOP-1 = 1) if a process to negotiate GHG emission reduction targets is started or continued. If the negotiating states finally agree upon GHG emission reduction targets, COOP-1 takes the highest (ordinal) value 2.

Similarly, there are also three levels of cooperation with regard to the second issue: the mechanism to sanction violation of agreed reduction targets is not developed further; a process to develop a new or to strengthen an existing compliance mechanism is started or continued; the negotiating states finally agree upon a compliance mechanism. These outcomes are encoded by variable COOP-2 with (ordinal) values 0, 1, and 2 respectively. The aggregate index COOP measuring

the dependent variable cooperation is the sum of both sub-indices, COOP-1 and COOP-2.

5. How leadership affects cooperation: results

Table 5 reports the values of the independent variable, LS-TOTAL (with all its sub-indices) as well as the values of the dependent variable COOP for each COP between 1995 and 2008.[16] Both variables vary over a significant part of the intended domain, indicating that the leadership index indeed differentiates between different COPs.

YEAR	COP	LS-UNI	LS-STRUCT	LS-PROB	LS-INTEL	LS-INST	LS-TOTAL	COOP
1995	COP 1	0.500	0.000	0.500	0.250	0.000	1.750	2
1996	COP 2	0.500	0.000	0.250	0.750	0.750	2.750	1
1997	COP 3	1.000	0.000	0.500	0.750	0.750	4.000	3
1998	COP 4	0.000	0.000	0.000	0.500	0.750	1.250	1
1999	COP 5	0.500	0.000	0.250	1.000	0.750	3.000	1
2000	COP 6	0.000	0.000	0.250	0.250	0.250	0.750	0
2001	COP 6b	0.667	0.500	0.250	1.000	0.250	3.833	2
2001	COP 7	0.333	0.000	0.250	1.000	0.750	2.667	2
2002	COP 8	0.167	0.000	0.250	0.750	0.250	1.583	0
2003	COP 9	0.000	0.000	0.500	0.750	0.500	1.750	0
2004	COP 10	0.000	0.000	0.250	0.500	0.500	1.250	0
2005	COP 11 & COP/MOP 1	0.500	0.500	0.000	1.000	1.000	4.000	3
2006	COP 12 & COP/MOP 2	0.167	0.000	0.250	1.000	0.500	2.083	1
2007	COP 13 & COP/MOP 3	0.500	0.500	0.500	1.000	0.500	4.000	1
2008	COP 14 & COP/MOP 4	1.000	0.000	1.000	0.500	0.500	4.000	2

Table 5: The EU's leadership in ICCMP and the level of cooperation achieved at the COPs between 1995 and 2008

Figure 2 breaks down the EU's leadership into its five modes. It emphasizes that EU leadership has been high (LS-TOTAL > 3.5) in 1997, 2001 (at COP 6b), 2005, 2007 and 2008. Hence, the measurements partially reflect the assessments in the literature (cp. Ott 1997: 176; Ott 2001: 476; Schreurs & Tiberghien 2007: 19f.; Oberthür & Kelly 2008: 36). Conversely, the EU has shown relatively little leadership (LS-TOTAL < 1.75) in 1998, 2000, 2002 and 2004. Again, this view is shared by non-quantitative assessments by Ott (2000: 174) and Hovi et al. (2003: 17f.). Interestingly, the EU's highest leadership value achieved is 4; given that the theoretical maximum of LS-TOTAL is 7, this means the EU has not realized her full leadership potential.

Concerning the dependent variable, the nations have been cooperating at a high level (COOP = 3) in 1997 and 2005, while cooperation was low or failed completely (COOP = 0) in 2000, 2002, 2003 and 2004. Thus, the two COPs with the highest levels of cooperation are among those at which the EU showed strong leadership; and three out of four COPs at which the EU showed little leadership are among those at which cooperation failed. This is a first set of evidence supporting our hypotheses.

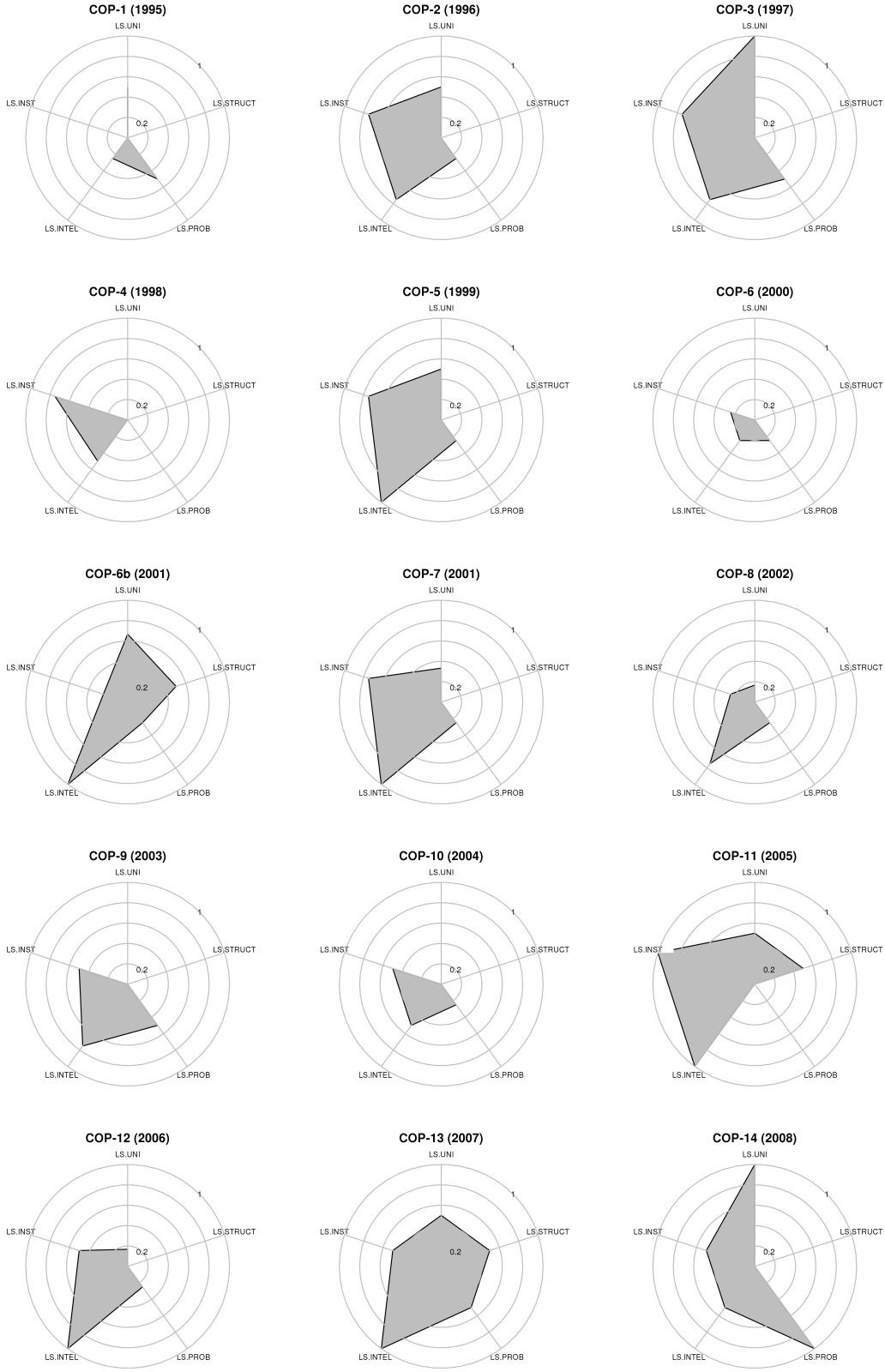
COP-1 (1995)
COP-2 (1996)
COP-3 (1997)
COP-4 (1998)
COP-5 (1999)
COP-6 (2000)
COP-6b (2001)
COP-7 (2001)
COP-8 (2002)
COP-9 (2003)
COP-10 (2004)
COP-11 (2005)
COP-12 (2006)
COP-13 (2007)
COP-14 (2008)
LS.UNI
LS.STRUCT
LS.PROB
LS.INTEL
LS.INST
0.2
1

Figure 2: The EU's leadership in five leadership modes at the COPs between 1995 and 2008

Statistical analysis further strengthens this result: Treating COOP as ordinal scale data, the Spearman's rank correlation between LS-TOTAL and COOP is $\rho = 0.731$ ($p = 0.002$): Hence, leadership is indeed positively associated with cooperation (cp. Figure 3 for an illustration).[17]

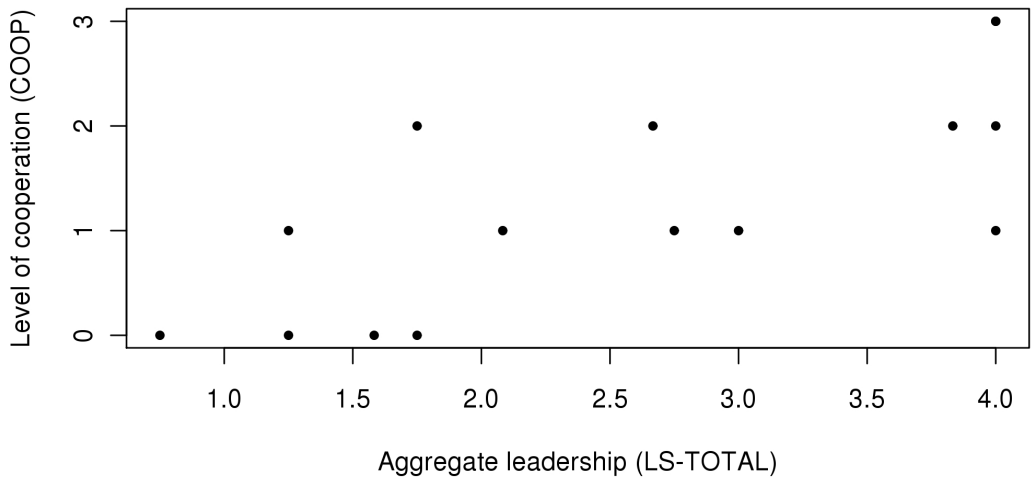

Figure 3: The association between the level of aggregate leadership, LS-TOTAL, and the level of cooperation, COOP (n = 15)

The association is fitted well by a proportional odds logistic regression model, with LS-TOTAL being the predictor variable (*pseudo-R^2* = 0.561,[18] p = 0.001): The probability for high-cooperation outcomes (as predicted by the statistical model) increases with increasing EU leadership, while the probability for low-cooperation outcomes decreases (cp. Figure 4); for instance, the probability that cooperation is highly successful (COOP = 3) grows from about 1 per cent at low levels of leadership (LS-TOTAL = 1.75) to about 38 per cent at high levels of leadership (LS-TOTAL = 4). Given the non-experimental design of the study, the coefficient of determination is relatively high. Hence, the EU's aggregate leadership is indeed a suitable predictor for estimating the level of cooperation in ICCMP: The more the EU engaged as a leader, the more cooperation was achieved.

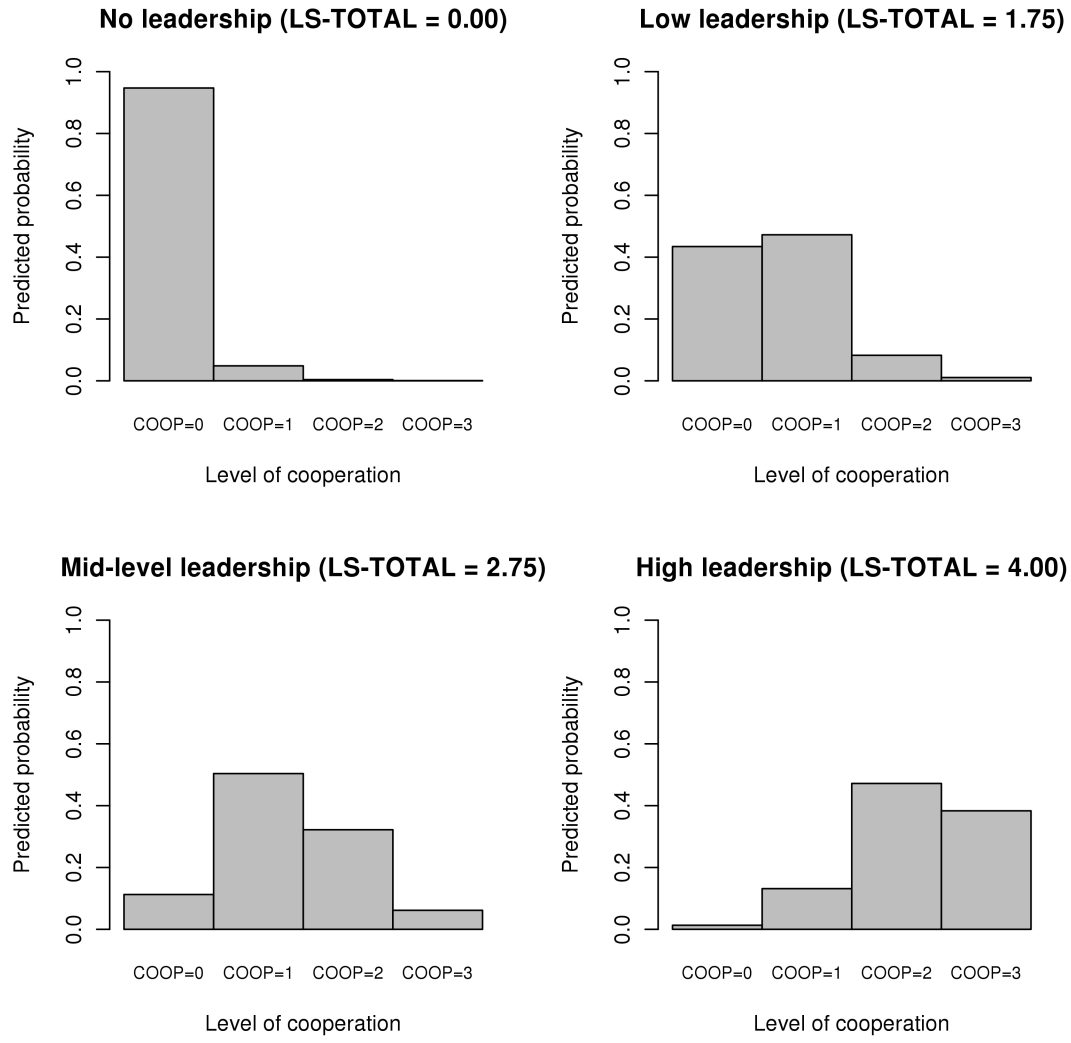

Figure 4: Predicted probabilities for the level of cooperation at different levels of leadership using a proportional odds logistic regression model

The hypotheses set out in the theoretical part of this paper also suggested a positive relationship between cooperation and each leadership *mode*. The statistical analysis is less univocal in this respect (cp. Table 6): For each leadership mode, the (rank) correlation between the mode and the level of cooperation is positive, which is

consistent with out hypothesis. While the correlation is close for unilateral leadership, it is weak to moderate for structural, intellectual and institutional leadership; there is no evidence that problem-solving leadership positively contributes to cooperation. In part, this may be due to the little variability in these variables (LS-UNI takes six different values, while the other variables take less). However, the correlation is statistically significant for unilateral leadership only. A proportional odds logistic regression model with LS-UNI as the predictor variable shows that unilateral leadership itself even better accounts for the variability in the level of cooperation than the aggregate leadership index does.

Relation between COOP and	Spearman's ρ (p-value)	Kendall's τ (p-value)	*pseudo*-R^2 (p-value)
LS-UNI	0.785 ($p = 0.001$)	0.687 ($p = 0.002$)	0.614 ($p < 0.001$)
LS-STRUCT	0.361 ($p = 0.187$)	0.331 ($p = 0.177$)	n. a.
LS-PROB	0.095 ($p = 0.737$)	0.079 ($p = 0.732$)	n. a.
LS-INTEL	0.292 ($p = 0.292$)	0.247 ($p = 0.277$)	n. a.
LS-INST	0.371 ($p = 0.173$)	0.329 ($p = 0.144$)	n. a.
LS-TOTAL	0.731 ($p = 0.002$)	0.617 ($p = 0.004$)	0.561 ($p = 0.001$)

Table 6: Statistical characteristics of the different leadership modes

In summary, the statistical analysis supports the hypotheses derived from the theoretical model for aggregate leadership and for the unilateral leadership mode; with regard to the other leadership modes, empirical evidence is consistent with our hypothesis, but fails to support it.

6. Discussion

The analysis suggests that aggregate leadership is indeed an important factor for cooperation in ICCMP. However, it is important to note that the operationalisation of cooperation focuses on the *output* of ICCMP-negotiations (regime formation) rather than on the *impact* of the regime on climate change mitigation. Therefore, the conclusion to be drawn from the analysis is that leadership facilitates regime formation. Whether or not these regimes effectively deal with the underlying collective problem is a separate question which we have not addressed (for this, cp. Miles et al. 2001).

The positive effect of leadership on cooperation (regime formation) seems to also hold for unilateral leadership but not for other leadership modes. Moreover, the cooperation-facilitating impact of (aggregate) leadership can ultimately be ascribed to a single mode, unilateral leadership. This suggests that unilateral leadership may be the most important leadership mode with regard to cooperation, while the role of sanctions and incentives (structural leadership), negotiation skills (problem-solving leadership), weltanschauung (intellectual leadership) or the ability to supply institutions (institutional leadership) in promoting cooperation may be overestimated. At the outset, we distinguished two intentions that make a leader: he wants to (a) contribute to solving a collective problem and (b) to encourage others to contribute to solving it. Unilateral leadership mainly serves the first intention, which may be called the "exemplary function" of a leader, while the other leadership modes relate to the second intention, the "emulation function". With this terminology at hand, the empirical evidence suggests that in ICCMP the exemplary function is more conducive to cooperation (regime formation) than the emulation function. This might

have important policy implications: “Putting one's own house in order first” is more likely to get others on board than directly pushing them to do their share.

However, one has to be cautious: First, as noted in section 4, the operationalisation of unilateral leadership depends on a very rough (and possibly overestimating) approximation of the reduction burdens the EU really has to face. Second, the operationalisation of problem-solving leadership does not take into account the course of informal negotiations. These two qualifications indicate that the data overrates the contribution of unilateral leadership and underrates the impact of problem-solving leadership. Third, one has to keep in mind that we have not considered the leadership behaviour of other agents than the EU. So the finding that unilateral leadership is more conducive to cooperation than other modes may be due to the EU's particular pattern of leadership behaviour rather than an intrinsic feature of the leadeship modes.

To comprehensively evaluate the proposed model, one should compare it with competing models. The relevant alternatives are Young's, Underdal's and Malnes' models, each of which considers (a different number of) different leadership modes (cp. Table 2). By treating our sub-indices as operationalisations of the corresponding leadership modes of these models, it is possible to construct a leadership index for each alternative leadership account. More specifically, leadership according to Young's model, LS-YOUNG, is the sum of LS-STRUCT, LS-PROB and LS-INTEL; leadership according to Underdal, LS-UNDERDAL, is the sum of LS-UNI, LS-STRUCT and LS-PROB; finally, leadership in Malnes' model, LS-MALNES, is calculated as the sum of LS-UNI, LS-STRUCT, LS-PROB and LS-INTEL.[19] To

compare the performance of theses indices with our model, each index is subject to the same statistical analysis as before. The results are given in Table 7, along with the number of leadership modes each model considers and the number of levels the predictor variable attains: All indices positively correlate with the level of cooperation, although the correlation fails to be statistically significant for Young's model ($p > 0.05$). The correlation is slightly higher in the model proposed in this paper than in Underdal's and Malnes' model; the *pseudo-R²* values are, however, significantly higher in the proposed model.

model	no. of modes	no. of index levels	different weights?	rank correlation with COOP		*pseudo-R^2*
				Spearman's ρ	Kendall's τ	
Young	3	7	no	0.489 ($p = 0.064$)	0.382 ($p = 0.080$)	0.171 ($p = 0.107$)
Underdal	3	10	no	0.710 ($p = 0.003$)	0.563 ($p = 0.008$)	0.397 ($p = 0.009$)
Malnes	4	12	no	0.664 ($p = 0.007$)	0.514 ($p = 0.015$)	0.414 ($p = 0.007$)
proposal	5	10	yes	0.731 ($p = 0.002$)	0.617 ($p = 0.004$)	0.561 ($p = 0.001$)

Table 7: Statistical comparison of competing leadership models

There are three reasons for this: First, as Table 7 illustrates, the explanatory power of the models (as captured by the *pseudo-R²* value) increases with the number of leadership modes considered and the number of levels the predictor variable takes. In other words, the more differentiated the underlying leadership concept, the better the model accounts for the cooperation-facilitating impact of leadership. The conceptual work of section 1 – a pre-condition of a differentiated operationalisation of the independent variable – therefore pays off in terms of empirical success.

Second, the proposed model is the only one using different weights for different leadership modes. Differential weighing was justified by theoretical considerations in sections 2 and 3: A simple game-theoretic analysis of the interaction in ICCMP shows that different leadership modes facilitate cooperation by overcoming different impediments to cooperation. Therefore, the theoretical work in sections 2 and 3 can also be considered as a pre-condition of the empirical success of the proposed account.

Third, one has to keep in mind that we apply Young's and Malnes' conceptions to collective agents and thereby extend them beyond their originally intended scope (cp. footnote 1). This may also account for their relatively weak empirical performance.

Conclusion and outlook

This paper examined whether – from an empirically informed standpoint – ICCMP can expect progress from the common call for leadership. The answer is to the affirmative: Empirical evidence suggests that aggregate leadership indeed positively contributes to cooperation (conceived as output) in ICCMP. One leadership mode, unilateral leadership, seems to be especially important in this respect; thus, setting a good example by significantly contributing to climate change mitigation could be a key to cooperation in ICCMP. Moreover, the proposed five-dimensional leadership concept better accounts for the positive correlation between leadership and cooperation than the prevailing accounts of Young, Underdal and Malnes do.

However, these results are subject to some limitations and there remain at least three open questions about their scope:

1. Are the results *policy-specific*? The present study has focused on ICCMP; as climate policy does not only consist of mitigation policy, a natural question is whether leadership also promotes cooperation in other climate issues (such as climate change adaptation policy) or other policy fields (biodiversity, disarmament). The interaction between the involved political agents may then have a different game-theoretic structure; consequently, the impediments to cooperation can differ and so do the ways in which a leader may overcome these impediments. The results of such an inquiry may complement the present study and show whether the impact of leadership on cooperation depends on the policy area.
2. Are the outcomes *agent-specific*? The paper equated leadership at the COPs with leadership *as shown by the EU* at the COPs. This is a restriction, although a justified one: The EU is generally regarded as the only agent having potentially been capable of taking the lead in ICCMP. Nevertheless, this assumption should, in principle, be subject to empirical scrutiny. A more comprehensive approach to the impact of leadership on cooperation is to assign a leadership value to *each* agent considered relevant (cp. Breitmeier et al. 2006) and to aggregate these values to some index operationalising leadership as shown by the whole community of participating states. Such an approach would also cover the possibility that the EU's leadership efforts could be undermined by the "anti-leaders", i.e. states which actively obstruct ICCMP-negotiations. As "anti-leadership" behaviour potentially interferes with the – alleged – cooperation-facilitating effect of leadership, the data

might support the hypotheses even more strongly if we had controlled for anti-leadership. Further progress may be achieved by combining our approach with the one followed by Breitmeier et al. (2006), which also takes "laggards" into account (cp. footnote 5).

3. Are the results *model-specific*? The derivation of our hypotheses was based on a specific model of the interaction between the participating parties in ICCMP as a two-persons, one-shot prisoners' dilemma game. We sidestepped the questions of whether it is more appropriate to model the interaction as iterated, *n*-person games (cp. Sandler 1997: 29ff; Finus 2002). Such an approach would allow for a more sophisticated operationalisation, as it is likely to reveal further ways in which a leader may overcome impediments to cooperation.

These issues should be taken as pointers to further conceptual, theoretical and empirical research.

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Notes

1 We will continue to treat Young's and Malnes' accounts as if the apply to collective agents. The reason for doing so is that individuals in institutional bargaining act as representatives of collective agents (Underdal 1994: 180); therefore, these conceptions of individual leadership mirror properties of leadership of collective agents.

2 The agenda of international climate negotiations is set non-publicly and is therefore unsuitable for operationalisation. Hence, we ignore agenda-setting in the theoretical and empirical part of this paper.

3 The application of game theory to social phenomena is not uncontroversial. Although we partially agree with the criticism, we employ an instrumentalist understanding of game-theoretic models: We use them to derive hypotheses about the object of inquiry; and if these turn out to be true and informative, the use of game-theory seems justified.

4 [*R*,*R*] is said to be a "Pareto-optimal" outcome: Neither state can be better off without the other being worse off. This does not hold for [-*R*,-*R*].

5 We suppose that a leader is not himself a player in the game he affects. Cp. Colomer (1995) for an analysis assuming the contrary.

6 For reasons of cross-temporal comparability, "EU" refers to the EU-15 prior to the Eastern enlargement in 2004.

7 The only leadership index available so far can be derived from the International Regime Database (IRD) by Breitmeier et al. (2006). The IRD measures state leadership by two variables: It classifies each important state on a pusher-laggard-scale and determines whether each important states' effort was primarily "structural", "ideational" or "entrepreneurial". As the coding only covers the initial phase of international climate change policy and considers aggregated time periods (1992-1997 and 1997-1998), the IRD-data does not exactly fit our purposes: the IRD-data provides too few data points to quantitatively assess the relation between leadership and cooperation. We therefore use a more fine-grained time scale. Second, we want to take the IRD's assessment further: In addition to coding the *primary* leadership dimensions (of the EU), we want to assess the *degrees* to which these dimensions are realized.

8 The national communications are reports about the progress concerning the reduction of GHG emissions which every party of the UNFCCC is obliged to periodically deliver.

9 The data source for this assessment is the GHG inventory, an annual report by the European Environmental Agency. The linear target path shows the EU's annual reduction until 2010 (as average of the emissions of 2008-2012) if it were to achieve its reduction target (eight percent less GHG emissions than in 1990 by 2010) in a linear reduction scenario, i.e. with constant absolute yearly reductions of 0.4 percent of the 1990 emissions.

A slight complication is that the Kyoto Protocol was agreed on in 1997, while the time frame considered here starts in 1995. However, a stabilisation of GHG

emissions on 1990 levels was already agreed upon in the UNFCCC in 1992. Therefore, for 1995 and 1996, TAR-A1 is "1" if and only if the EU's GHG emissions were below or equal to the GHG emissions of 1990.

10 Focussing on trade sanctions is in line with the observation that in international policy in general, sanctions are mainly trade sanctions (Viguier 1994: 197). However, the unavoidable reference to trade policy introduces an irreducible element of issue linkage.

11 Here (and in some other comparisons to follow), choosing the G7-states as an object of comparison is imperative because only the G7-states can significantly finance development aid; all other states would be overtaken by the EU anyway. As the contributions of the G7-members France, Germany, Great Britain and Italy are already accounted for by the EU-budget, the proper comparison is between the EU and the non-European G7-states.

12 One problem with this operationalisation is that it does not account for the fact that problem-solving leadership mainly manifests itself in informal negotiations which are not covered by the formal COP-minutes. This partially explains why our data for LS-PROB (cp. section 5) overrates problem-solving leadership in 1997 (cp. Grubb et al. 1999: 112) and underrates it in 2001 (cp. Hovi et al. 2003: 18f.).

13 We only considered absolute contribution and did not undertake a comparison relative to the gross domestic product; this is because the financial contributions to the IPCC are so little that financial support will depend on the good will of a state only – and not on its financial potential.

14 The EU's contribution is defined as the sum of the voluntary contributions of the EU-15 and the European Commission to the “Supplementary Fund” and the “Participation Fund” of the UNFCCC.

15 We sidestep the question of whether the reduction targets and the sanctioning mechanism are effective in mitigating climate change. The operationalisation thus frames cooperation as output rather than impact (cp. section 6). The reason for doing so is that, until now, ICCMP-negotiations have not helped avoiding climate change. So the "impact-component" of cooperation in ICCMP is virtually zero.

An alternative attempt to measure cooperation (as output) frames the *differences* in cooperation levels as “policy change” and then applies a classification of different levels of policy change (as developed by Hall 1993). However, this approach does not fit the purpose of this paper, because the concept of policy change and the concept of cooperation can fall apart: The policy change between two consecutive COPs may be small (e.g. an increase in the reduction target from -30 per cent to -32 per cent) even though the level of cooperation achieved is high at both COPs.

16 The complete data set, including data sources, is available at http://www.leadership-index.de.

17 Of course, the correlation design of our inquiry does not support the conclusion that leadership *causes* cooperation to be higher.

18 As an estimator of the coefficient of determination we used Nagelkerke's R^2 (Nagelkerke 1991).

19 In each case, the summands are of equal weight because these models do not allow a derivation of different weights. In speaking of "leadership according to *X*'s model" we refer to our most charitable understanding of the respective account. We do not claim that the indices which we construct on behalf of Young, Underdal and Malnes are the indices which they themselves would have come to if they empirically tested our hypothesis within their models.